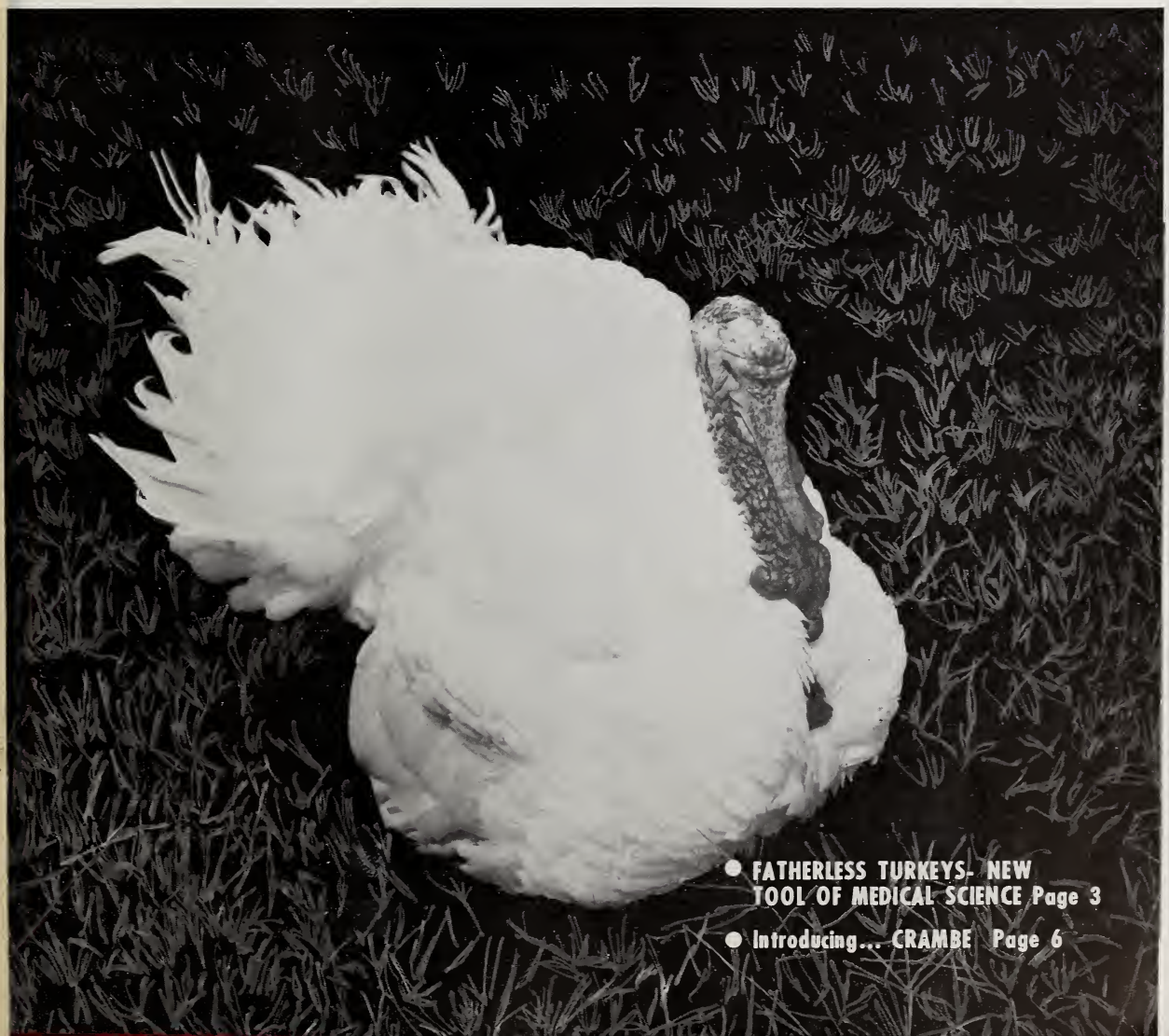
AGRICULTURAL Research

November 1962 / U.S. Department of Agriculture



AGRICULTURAL
Research

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Medical Science and The Turkey

A steam shovel recently unearthed bones of a prehistoric whale while digging a foundation for a generating plant. By so doing, the electric industry aided the science of anthropology.

Like the steam shovel operator, ARS scientists are digging deeply for agricultural research findings. They uncover many tools helpful to other sciences. Medical research, for example, is benefiting from ARS findings in such specific areas as skin grafting, cancer immunization, and virus diseases.

More tools of non-agricultural sciences undoubtedly will be uncovered as basic agricultural research is intensified to provide vitally needed building blocks for applied research. Findings today, however, may not be applicable for years to come.

In 1953, for example, fatherless turkeys were discovered by ARS animal husbandmen doing basic studies. They found that embryos can develop in unfertilized turkey eggs—and that certain live poultry viruses can trigger an increase in the number of these fatherless birds in a given flock.

Today many fatherless turkeys are living to maturity, and some are being used in skin-grafting research by medical scientists of Columbia University. Not only has the knowledge of skin grafting been enhanced, but the studies have confirmed the development of turkey embryos by parthenogenesis.

In 1949 ARS scientists at East Lansing, Mich., discovered that poultry cancer is virus caused. They have transmitted the disease to other chicks and immunized chicks against it. These studies may have far-reaching effects on research of various types of cancers, including cancer in man.

Today USDA's research on avian leukosis, cancerous disease of chickens, has been intensified as the result of a cooperative agreement—including a grant of $99,835—with the American Cancer Society, Inc.

For Years USDA scientists have been probing the unknown to learn how viruses develop and cause disease in plants. An important advance was made recently when an ARS plant pathologist isolated an immature form of tobacco mosaic virus (TMV) from leaves of tobacco plants.

In the future man may be able to study the steps involved in formation of virus within plant cells—even within cells of domestic animals and humans.

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AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture

FATHERLESS TURKEYS: NEW TOOL OF MEDICAL SCIENCE

USDA-Columbia research is successful in grafting skin from a turkey parthenogen to its mother

■ Fatherless turkeys produced by USDA researchers at Beltsville, Md., have recently been used in skin grafting research by medical scientists of Columbia University's College of Physicians and Surgeons in New York City.

The study has provided knowledge about the role of inheritance in the body's ability to accept or reject skin grafts. Except in the case of identical twins, grafting of skin from one person to another has been unsuccessful.

The fatherless turkey, possessing only those genes (units of inheritance) it received from its mother, shows promise as a research tool for scientists studying human tissue grafting.

ARS poultry researchers cooperated in the study, which also has confirmed the unique development of the turkeys by parthenogenesis—the production of offspring from unfertilized eggs.

The scientists grafted small patches of skin from the fatherless turkeys (parthenogens) onto their dams. All the grafts were permanently accepted by the mothers; the offspring's skin developed normally when substituted for skin removed from the dam. Grafts from dam to offspring and from one parthenogen to another, however, were rejected; the grafted skin degenerated on the recipients.

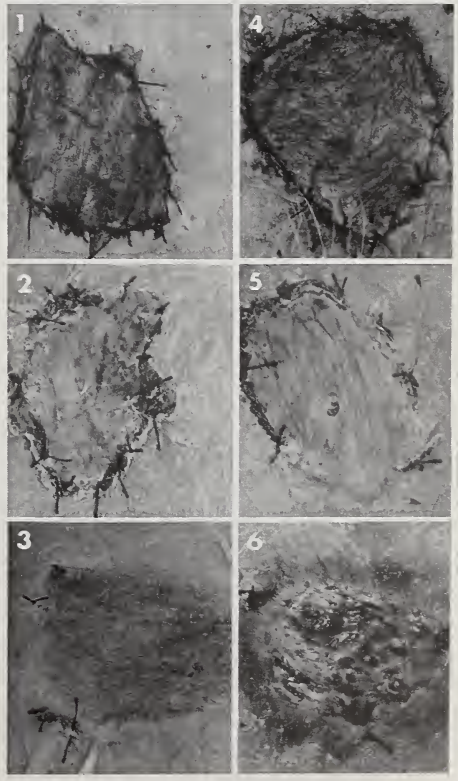
The Columbia surgeons, W. V. Healey and P. S. Russell, worked at Beltsville and New York in cooperation with poultry physiologist M. W. Olsen and geneticist H. K. Poole of ARS. The study was financed in part with grants from the U. S. Public Health Service.

Properties of offspring's skin like dam's

The researchers say the dams were able to accept grafts from their parthenogenetic progeny because none of the properties of the offspring's skin was foreign to its mother. The parthenogen's skin was actually as acceptable to the dam as an autograft (a patch of its own skin grafted to another part of its body) would be.

The parthenogens rejected skin grafts from their dams, as the scien-

Turn Page



The skin graft from a fatherless turkey (left panel) was accepted by its mother, but the graft from a normal offspring (right panel) was rejected. Photographs 1 and 4 show skin patches immediately after being grafted; 2 and 5, nine days after; 3 and 6, twenty-seven days after.

TURKEYS

(*Continued*)

tists expected. Since the fatherless progeny received only a sample half of their mother's genes, the mother's skin had properties foreign to her offspring.

Rejection also occurred when a dam received grafts from normal offspring resulting from mating. Because of the genes contributed by the sire, both the offspring and the mother had skin properties that were foreign to each other.

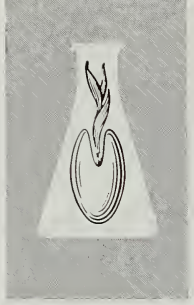
Grafts between parthenogens rejected

Grafts between parthenogens were similarly rejected; each was genetically unlike the other. These rejections, especially significant to the poultry scientists, proved the parthenogens inherited normal tissue antigens—agents that stimulate antibody production.

Had the grafts between parthenogens been accepted, the scientists would have suspected an inability to produce antigens normally. The birds might have been unable to produce antibodies to reject foreign grafts or to make their skin be rejected by other birds.

Olsen heads ARS research on parthenogenesis in turkeys (AGR. RES., August 1953, page 4; June 1956, page 3; and November 1957, page 3). Through selective breeding he and his associates increased the incidence of natural parthenogenesis in turkeys to the extent that living offspring were produced. Many have lived to maturity—all are male—and have sired offspring.

The scientists are currently studying the causes of parthenogenesis. They have learned, for example, that certain live poultry viruses can trigger an increase in a turkey flock's rate of parthenogenetic egg production, which normally is quite low.☆



Eleventh in a Centennial Series

Culture collection supplies source of new products: penicillin, dextran, gums.

INDUSTRIAL UTILIZATION

Flow of raw materials from farm to factory expands through research at regional laboratories

■ American farms have become the starting point of many factory assembly lines—helping industry produce a growing list of products that make life better for all 180 million of us.

Corn, cotton, wool, wheat, animal fats, hides and skins, pine gum, linseed and castor oils, edible vegetable oils—and many others—are being transformed into new and valuable industrial products.

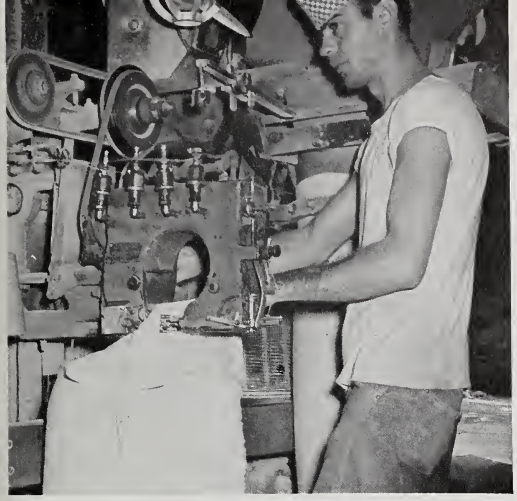
This changing of familiar farm foods and fibers to increase their usefulness and gain new markets has been made possible by utilization research and development.

Industrial use of agricultural products began on this continent in 1527, when pine gum was used to make tar and pitch for calking the hulls of wooden ships and for water-proofing rigging. But agricultural utilization research gained little during the next 400 years. Then, in 1940, four USDA Utilization Research Laboratories were established in Albany, Calif., New Orleans, La., Peoria, Ill., and Philadelphia, Pa.

The years since 1940 have seen the greatest scientific and technological advances in history, and utilization research has played a big part.

For example, the first "wonder drug," penicillin, was mass-produced by a USDA utilization research process. By making available large amounts of this drug, ARS research helped launch a new industry.

Cotton has faced intense competition from synthetic fibers. The answer from USDA utilization scientists, working with other research organizations and the cotton industry, is cottons that resist fire, rot, heat, and scorch, and drip-dry cottons that need little or no ironing. Now



Animal fat—500 million pounds a year—is used as a feed additive because of ARS research.

Dialdehyde starch adds strength to paper.

New oil-based paints wash away with water.

under development are stretch cottons, which are expected to find widespread use in clothing and home furnishings and industrial fabrics.

"Wurlanize" is a new word that may herald a new era of shrinkproof, easy-care woolens. This new USDA-developed treatment (named after the Western Utilization Research Laboratory) is now being evaluated by industry. It makes wool as machine washable as present-day cottons.

Utilization research has also developed new leather tanning materials, such as glutaraldehyde, which give leather entirely new properties and should enable it to find important new outlets in the apparel market.

The first successful use of cereals as an integral part of paper is a potentially valuable result of utilization research on grains. Chemically treated starches, flours, wheat bran, or ground whole wheat have been used with wood pulp in experimental papers of superior strength.

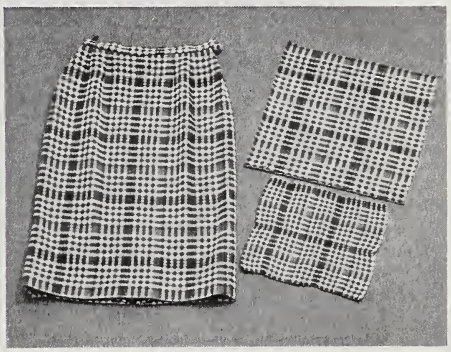
New uses are found for fats

As synthetic detergents have replaced soap, utilization research has been pressed to find new uses for animal fats. Discovery of the value of these fats as feed additives has opened up their biggest new market, about 500 million pounds a year. Other fat-based products having important industrial potential include the epoxy compounds, which are used as plasticizers, special lubricants, and lubricant additives. Many of these industrial uses are applicable to vegetable oils as well.

Linseed oil emulsion paints, which combine the convenience of water-based paints and the protectiveness of linseed oil paints, stem from utilization research. These new exterior paints adhere to chalky surfaces, dry quickly, resist blistering, and rinse from brushes with water.

Several manufacturers of multipurpose urethane foams are using variations of USDA formulations that have a castor oil base.

Research on pine gum and its main derivatives, turpentine and rosin, has resulted in important new chemicals. Among these are paramenthane hydroperoxide for making "cold" rubber, myrcene for perfume ingredients, and maleoprimaric acid for photographic processes.☆



Wurlanizing prevents shrinkage of wool. Skirt and upper square were treated; all were machine washed.

These all-cotton socks fit the same size foot. Smaller sock was made of all-cotton stretch yarn.

Introducing . . .

CRAMBE

Mediterranean plant could be domestic source of erucic acid oil, now imported for industry

This crambe is in the flowering-fruiting stage. First pods remain on stalks until last pods mature.

Erucic acid is treated with ozone in pilot-plant studies using the acid to make other industrial chemicals.

Crambe grows about 3 feet high. Seed is borne on long spikes; pods are about the size and shape of grape seed.

■ An introduced plant called crambe (CRAM-bee) may be an outstanding find in the extensive ARS search for new crops that will produce oils in demand by U.S. industry.

Crambe (*Crambe abyssinica*), a plant that grows wild in the Mediterranean region, is in the same family as the rapes and mustards. Its seed is a rich source of erucic-acid oil, an industrial raw material now obtained from imported rape-seed oil and used mainly in rubber manufacture.

ARS scientists envision many industrial markets for crambe-seed oil, including its use in the manufacture of synthetic fibers, detergents, plastic coatings, high-detergent lubricants, and resin paints. These potential markets, the scientists believe, could warrant the planting of more than 65,000 acres of this new crop.

All the cultural operations—planting, cultivating, and harvesting—required in the production of crambe can be performed with machines grain producers already have. And the oil can be extracted by processes now used in industry.

Field testing is underway

Advanced field testing of crambe is underway this year, under the direction of ARS horticulturist J. R. Haun. Widely scattered trials will help scientists determine the areas best suited to production, as well as the influence of temperature, soil, water, planting depth, and fertilization on yield and quality of the seed.

Studies show that crambe can be grown as an irrigated or dry-land crop in areas where temperatures are relatively cool during the growing season. In early field trials the crop did well in Montana during the summer months and in southern Texas in the winter. Yields averaged better than 1,000 pounds of seed per acre, and the plant proved remarkably resistant to disease and insect damage.

Crambe is an annual herb that grows about 3 feet high. Its flowers develop on 1- to 2-foot stalks or spikes

that shoot up sharply from the plant; flowering lasts several weeks. The pods, each containing one seed, are somewhat the size and shape of grape seeds. First-formed pods usually remain on the stalk until the last pods are mature—a characteristic that would facilitate mechanical harvesting.

New uses for oil explored

New uses for crambe-seed oil are being investigated by ARS utilization researchers. These uses are based on erucic-acid oil or derivatives of it.

Chemist I. A. Wolff, who heads chemical screening of new crops at the Northern utilization research laboratory, Peoria, Ill., says this acid has a chemical structure that is easily manipulated. It may prove useful, therefore, as a raw material in making other chemicals, such as brassylic and pelargonic acids.

Only a small amount of brassylic acid is now available; it is used in preparing chemical intermediates for perfume. High-purity grades of brassylic acid are in demand in the manufacture of polyamid fibers and lower purity grades in the making of plasticizers, polyesters, alkyd resins, lubricants, and surfactants. Among possible new uses is a process for applying a shrink-resistant finish to woolen textiles.

Source of jet-engine lubricant

Pelargonic acid is used in the production of jet-engine lubricants, plasticizers, alkyd resins, vinyl stabilizers, flotation agents, and insect repellents.

Researchers at the Peoria laboratory are also working on new processing methods for seed of the mustard-rape-crambe plant family. They are seeking processes that will yield not only high-quality oil but also bland meals suitable as protein supplements for livestock feed.☆

Crop Barrier Strips

Sudangrass proves best of four crops tested to reduce soil blowing

■ Barrier-strip plantings of sudangrass reduced winter and early spring soil blowing more effectively than strip plantings of three other annual crops in USDA tests at Akron, Colo.

Grain sorghum barriers were nearly as valuable as sudangrass for reducing wind velocity below the minimum speed at which soil blowing begins (14.25 miles per hour, measured 1 foot above ground surface). Forage sorghum and broomcorn strips gave less protection.

Other studies have shown that crop barrier strips are also useful for trapping blowing snow in moisture conservation (AGR. RES., Jan. 1961, p. 7) or for protecting young trees.

In experiments conducted by ARS agricultural engineer D. W. Fryrear, crop barriers were planted in June and were left standing until March of the following year. Wind-speed measurements were made on the leeward side of one- and two-row strips during the normally windy period of December, January, and February, when the erosion hazard is great.

Fryrear developed a mathematical index for measuring protection given by crop barriers. Relative effectiveness ranged from 0.85 (the poorest rating) for one row of Black Spanish broomcorn to 11.37 (the highest rating) for two rows of Greenleaf sudangrass. Ratings for other two-row plantings included 10.69 for RS 610 grain sorghum, 7.87 for Atlas forage sorghum, and 3.94 for broomcorn.

One-row plantings generally gave less protection than two rows. Scientists do not recommend single-row barriers because a uniformly dense stand is difficult to establish.

On the leeward side of the barrier strips, Fryrear found that two rows of sudangrass reduced wind velocity 60 percent at a distance equal to twice the height of the plants. At a leeward distance 10 times plant height, the sudangrass barrier reduced wind velocity 29 percent.

Two rows of grain sorghum reduced wind speed 44 percent at a leeward distance twice plant height—26 percent at 10 times plant height.

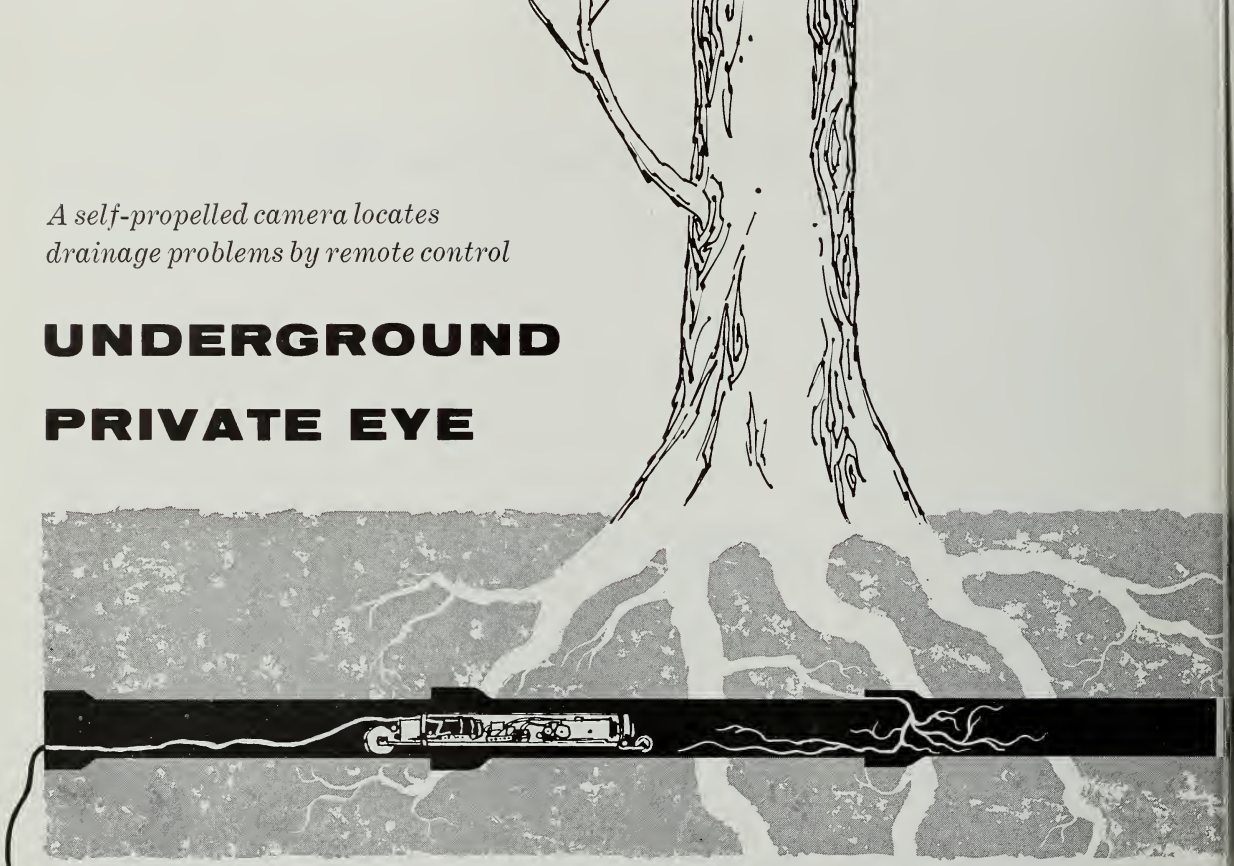
Fryrear calculated the spacing of barrier strips needed for keeping wind speeds below erosive velocity. To give protection from winds up to 40 miles per hour, sudangrass strips should be spaced at distances of no more than 7.5 times plant height. Distances between grain sorghum barrier strips should be no more than 6 times plant height.

All plantings lodged and lost leaves in the winter. Lodging did not reduce the protective value of sudangrass as much as that of grain or forage sorghums. Sorghum stalks are larger than sudangrass stalks, and the barrier became noticeably more porous when the larger stalks lodged.

Fryrear rated sudangrass good on ability to withstand weathering; grain sorghum and broomcorn, fair; and forage sorghum, poor. When measured March 1, sudangrass plants averaged 3 feet high; grain sorghum, 2 feet; forage sorghum, 1½ feet; and broomcorn, 4 feet.☆

A self-propelled camera locates drainage problems by remote control

UNDERGROUND PRIVATE EYE



Camera may be inserted in tile line at drainage outlet or at excavation point

A self-propelled "private eye" can inch its way through an underground drainage line in a farmer's field and record what it sees.

The device is a camera with remote control, built as a research tool to locate damaged or clogged tiles. It was designed by ARS agricultural engineer H. H. Shull at the Southwestern Irrigation Field Station, Brawley, Calif.

The camera may, following further studies, prove useful to farmers in finding clogged spots in their drainage systems. In many cases, only a few tiles may need replacing, but farmers have to dig up entire lines to find where clogging occurs. This is not only expensive, but it can affect cropping of relatively large areas.

With photographs from the self-propelled camera, scientists can inspect a much greater length of drainage line than is possible when a random tile is excavated and examined. They can insert the camera at the drainage outlet or at any point along a line where tile is exposed by excavation.

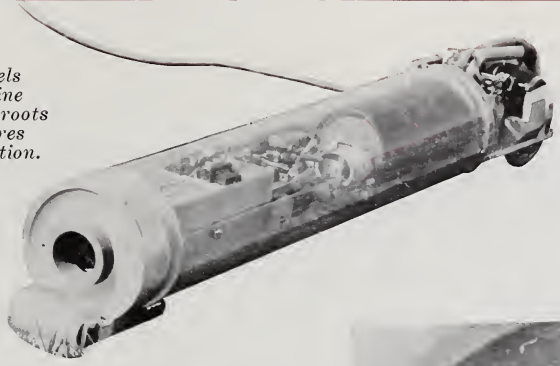
Compact unit is reversible

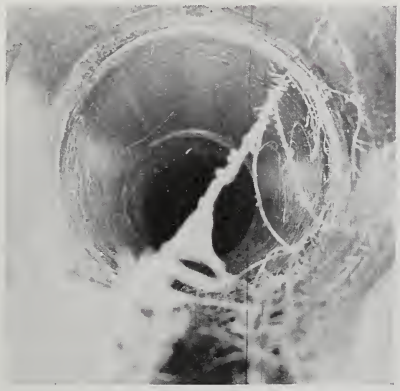
The experimental device consists of 35 mm. camera and electronic flash installed in a clear plastic tube about 3 inches in diameter and 16 inches long. The tube is mounted on two wide wheels, one at each end. A small reversible, battery-operated motor geared to the rear wheel moves the unit through the tile line.

Controls for the camera and motor are located in an above-ground unit connected to the tube by a cable. From this light-weight control unit the cameraman can operate the camera and flash device, advance the film, and move the tube forward or backward in the tile line. Plastic tabs on the control cable indicate the distance the camera tube has moved into the drain, which enables the operator to determine the exact location of clogging.

Pictures taken by the camera can show roots in drainage lines, gravel at the tile joints, and misalignment of individual tiles. In some drainage research, color photographs can be useful by showing the distinctive colors of various oxide deposits in the tiles.☆

Self-propelled camera travels through underground tile line until meeting obstruction (roots in drawing), which it pictures for later study, remedial action.

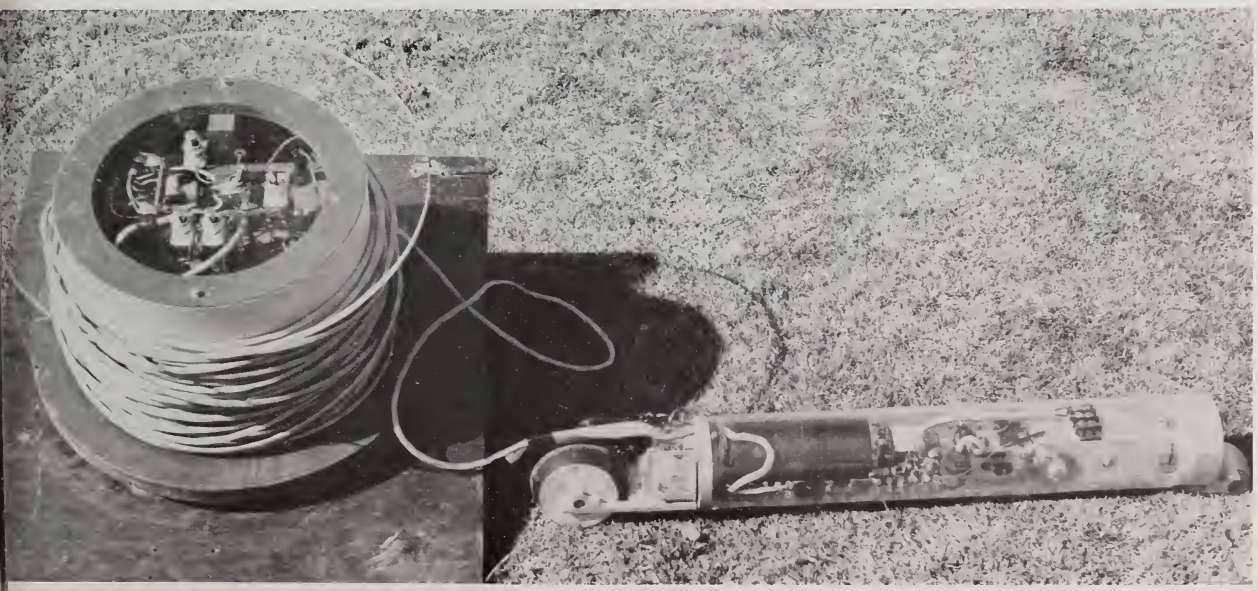




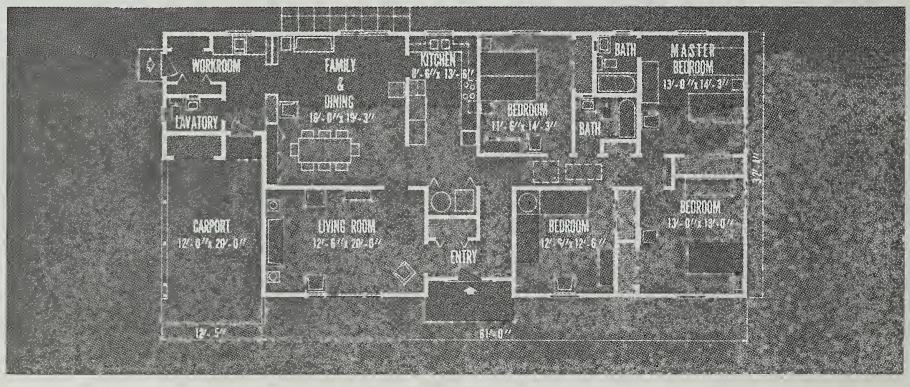
Camera-eye view shows roots that have penetrated a joint of 6-inch tile line.

The underground camera revealed this vertical misalignment of a tile joint.

The complete unit includes the below-ground camera and motor, which are encased in a clear plastic tube, and the above-ground control panel mounted in the take-up reel.



HOME OF CONVENIENCE



This four-bedroom farmhouse combines comfort and utility, indoors and out

■ Informal, pleasant family living—in and out of doors—is featured in a new USDA farmhouse plan.

A generous-sized family room, which doubles as a dining room, has sliding glass doors opening onto a patio at the rear of the house. The adjoining kitchen has a large window above the sink, enabling the homemaker to watch her children at play.

The new farm house (Plan No. 7162), contains more than 2,100 square feet of floor space and is equally suitable for town or city.

The plan includes a center-hall entrance, four bedrooms, and two and a half baths. The living room is located away from the major lanes of traffic and may be entered from the entrance hall or the family room. The four bedrooms are situated away from the living and work areas of the house. One bath adjoins the master bedroom, and another is centrally located for general use.

A workroom with its own outside entrance provides space for a washing machine and clothes dryer. The workroom also has storage space for canned goods, cleaning supplies, and work clothes. The half-bath, located just off the workroom, is convenient for changing clothes and washing up without going through the main part of the house. Another entrance way in the work area leads to a carport.

The house was planned by architects and housing specialists, who were guided by results of ARS and State housing research on space needed for household activities and for storage.

The farmhouse is designed for slab-on-grade construction. This type of construction, the home planners say, can be used on most sites except those that are poorly drained or underlain with clays that expand or contract. The plan provides for either truss roof construction or conventional rafter framing.

Working drawings of Plan No. 7162 are available through farm building specialists or extension agricultural engineers at most State agricultural colleges. There is usually a small charge.☆

TRACKING BOLL WEEVILS

Crime-detection powder helps scientists trace weevil living habits

■ Fluorescent powder, a material used in crime detection, is helping USDA entomologists learn more about the living habits of boll weevils.

The scientists dust weevils with the powder, which is invisible in daylight, and release them. At nighttime the weevils glow when a black (ultraviolet) light is shone on them.

By noting how far and how fast marked insects have travelled from a release point, scientists add to their knowledge about weevil movement. This detailed knowledge is useful in devising effective control methods.

ARS entomologists H. M. Taft and H. R. Agee developed the new insect-detection method in cooperative research with the South Carolina Agricultural Experiment Station.

In addition to improved detection, they say fluorescent marking may lead to greater knowledge of the way weevils feed, mate, and lay eggs.

Searching for glowing insects is much faster than hunting weevils marked by other methods. When dyed weevils are released, each cotton plant must be visually examined; when irradiated weevils are released, each plant must be inspected with a geiger counter. Glowing insects, however, can be detected as fast as one can walk. Stops are required only to make records or for closer observations.

Under a 6-watt black light, powdered weevils can be seen 12 feet away. The bright glow is even visible through a young, thin cotton leaf, the scientists report. Often, after a weevil has left a plant, enough powder remains on the foliage to give clues about its movements.

The fluorescent powder, which has no apparent physical effect on the insects, remained effective for 3½ months in the tests.☆

Forty percent of infertility in dairy and beef herds is attributed to . . .

VIBRIOSIS, villain of fertility

■ An example of how seriously vibriosis can affect cattle reproduction is shown by a recent ARS study of this venereal disease, which accounts for at least 40 percent of the infertility in beef and dairy herds.

A bull infected with *Vibrio fetus* was bred to 12 virgin, noninfected heifers. All became infected with the organism, and only two later showed evidence of pregnancy.

In contrast, six of seven other heifers became pregnant when bred to a noninfected bull.

The purpose of this study, conducted by veterinarian A. H. Frank and coworkers at USDA's National Animal Disease Laboratory, Ames, Iowa, was to locate changes in the reproductive tracts of infected females.

Seven of the twelve infected heifers soon came in heat again. This strongly indicates that vibriosis prevented conception in these animals. The other five heifers were slaughtered within 3 weeks after being bred and were examined for pregnancy and cellular changes.

Changes due to vibriosis occurred only in the endometrium, the membrane that lines the uterus. Other areas of the reproductive tract were no different from those of heifers not infected.

The vibriosis organism was present, however, in most of the reproductive parts of infected animals, including the uterus, cervix, and vagina.

This experimental work shows that vibriosis may be difficult to detect, but it should be suspected in herds with histories of poor fertility.

The only signs of infection may be poor conception rates of heifers, which may require multiple services before settling.

Cows previously infected by a bull may build an immunity to vibriosis and satisfactorily produce offspring thereafter. But these immune cows can remain carriers of the disease for indefinite periods and infect vibriosis-free bulls when bred.

Diagnosis of the disease is made by laboratory culture of mucous from the genitals of suspect cattle. Presence of *Vibrio fetus* organisms in the mucous indicates infection.

Cattlemen can develop vibriosis-free herds from infected ones by breeding heifers only to bulls proved free of the disease or by artificial insemination. Healthy animals and their offspring should be isolated from the rest of the herd.

There are several experimental treatments to rid bulls of vibriosis, but the remedies are expensive and laborious.☆

Devised:

A Test for Aleutian Disease of Mink

■ A test to detect Aleutian disease of mink has been devised by ARS and Washington State University scientists. The disease is similar to a number of human disorders, involving so-called auto-immunity, in which the body's defense mechanisms attack the body's own organs.

The test is the most promising yet found in research on ways to control Aleutian disease (AD), which cost mink farmers about a million dollars last year.

Mink have never been known to recover from AD, which produces abnormalities of the blood serum and inflammation of blood vessel walls. There is no cure or treatment. AD is like no other known livestock disease, and its cause is unknown.

The test involves drawing blood from a mink's toenail, obtaining serum, then mixing it with an iodine solution. If the mink has AD, this mixture looks opaque, granular, and milky. If not, the mixture is clear, brown, and watery. Serum of a diseased mink reacts because infection increases the gamma globulin and serum protein and decreases the albumin in the blood.

Accuracy of the test was demonstrated in laboratory and field studies. Of 250 mink shown to be diseased by the test, 233 cases were confirmed by examination of internal organs. Conversely, the test correctly identified 120 of 124 to be free of AD.

Veterinarians J. R. Gorham of ARS and J. B. Henson and R. W. Leader of Washington State University devised the test at Pullman. They are cooperating with several owners of affected mink herds in an effort to eliminate the disease.

In these herds, all mink reacting to the test are isolated and not used for breeding. This should greatly reduce the incidence of AD, since the disease may be transmitted from dam to offspring. In one study, reacting dams had more than twice as many infected kits as those that didn't react to the test. AD losses in one herd of mink were reduced by 80 percent by testing and removing reactors.

Although Aleutian disease is most prevalent in the Aleutian and other blue mink mutations, the disease occurs in other mink, too. And the number of cases is growing, both in affected herds and in herds previously free of the disease.☆

Growers may net $60 more per acre in Rio Grande Valley by . . .

Limiting Cotton Irrigation

■ Cotton receiving a single postplanting irrigation in the Lower Rio Grande Valley of Texas returned $60 more net income per acre than cotton receiving four irrigations.

The cotton that was irrigated one time—70 to 80 days after planting—yielded more, matured earlier, and produced a higher percentage of its total crop at first picking.

By eliminating three irrigations, growers can reduce labor and production expense and may be able to continue cotton production in years of severe water shortage. Or they may stretch water supplies over more area.

These findings are by ARS agricultural engineers at Weslaco, Tex., in cooperation with the Texas Agricultural Experiment Station.

The single postplanting irrigation was made when first cotton bolls were sightly more than half grown. It was compared with four other irrigations timed at initial bloom stage, at small boll stage, when some bolls were 50 percent mature, and when some bolls were fully mature.

Average production rate was 1,101 pounds of lint cotton per acre in the plots that received one postplanting irrigation, 1,088 pounds per acre in plots receiving four irrigations.

Cotton receiving the single irrigation also matured earlier. At first picking, 65 percent of the total amount produced was harvested from the one-irrigation plots, in contrast with only 35 precent from the four-irrigation plots. Early maturity generally means higher prices to growers.

The increased value of early cotton, coupled with lower production costs, netted $60 more per acre with one irrigation.☆

Soil crack formed by scoring soil with sweep plow.

CONTROLLED soil cracking

Principle of scoring concrete to avoid random cracking helps store, conserve soil moisture

■ Controlling the way soil cracks in the southwestern Great Plains may help solve the area's biggest problem in moisture conservation—getting water into the soil rapidly enough to avoid runoff and deeply enough to escape evaporation.

In tests conducted in Texas winter wheat fields, USDA soil scientists induced soil cracks that were wider and deeper—but fewer in number—than cracks that occurred naturally.

Bigger but fewer cracks should benefit the soil moisture condition in two ways: (1) Wide cracks should allow runoff water to enter the soil rapidly and penetrate deeply enough to be stored for absorption by plant roots. (2) There should be less moisture loss by evaporation because a few large cracks have less total evaporating surface than many small cracks have.

ARS soil scientist W. C. Johnson is conducting moisture conservation studies in cooperation with the Texas Agricultural Experiment Station.

The principle used to induce soil cracking is the same as that used to produce large cracks at desired intervals in concrete sidewalks. To prevent hairline cracking in the concrete slabs, the wet concrete is scored at intervals to provide definite weak places where a few large cracks form as the material dries.

Soil scoring in Johnson's studies was made in a grid pattern, using an 18-inch sweep plow. Every fifteenth row of wheat (rows were 14 inches apart) was plowed out in scoring the soil in one direction; then the soil was scored every 10 feet in the other direction.

Soil cracking is evaluated

The soil was relatively moist when the scoring was done in April; and as the soil dried, cracking occurred both from scoring and from natural causes. Soil cracking was then evaluated.

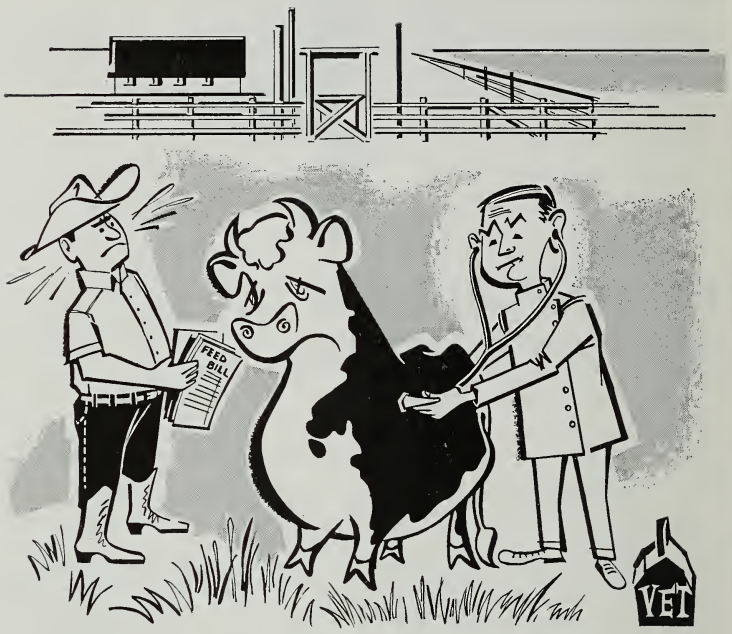
- The larger size of the induced cracks (1½ to 2 times wider than naturally occurring cracks) indicates that the upper limit of crack size can be increased.
- Proportionately, there was no difference in the number of induced cracks from plowing parallel to the rows compared with plowing perpendicular to the rows.
- The most desirable cracks were those formed in the scored strips running perpendicular to the rows. These cracks intercepted runoff moving in the natural channels between the wheat rows.
- On the average, induced cracks perpendicular to the wheat rows were one-third wider than those parallel to the rows. Naturally occurring cracks had the same average width, whether they were parallel or perpendicular to the rows.

These studies were made on Pullman clay loam, a soil on which much wheat is grown in Texas and adjoining States. The degree of soil cracking differs from one soil type to another because of the variation of soil characteristics.

In further research, scientists will study the effect of induced soil cracks on yield. They will also determine how much runoff water can enter the soil through the cracks and how much evaporation is likely to occur.☆

WHY OVERFEED COWS?

Overfed beef cows cost more to maintain, return less than maintenance-fed group in Oklahoma herd



"It's not WHAT she ate. It's HOW MUCH."

■ An overfed cow may look nice, but she isn't as long-lived—or as profitable—as the cow fed just enough to stay healthy, ARS and Oklahoma scientists are finding.

Sixteen of 30 beef cows fed a restricted but adequate ration since 1948 are still in an experimental herd. In contrast, only 5 of 30 overfed beef cows remain in the herd.

What's more, leaner females outperformed their better fed mates. Accumulative totals show the leaner group had a bigger calf crop (90 percent weaned vs. 84 percent); lower feed, pasture, and mineral costs ($375 per cow vs. $645); and a higher net return ($29,500 vs. $16,500).

The experiment was conducted at USDA's Fort Reno Livestock Research Station, El Reno, Okla., to learn amounts of feed to give cows on winter pastures in the area. Researchers were D. F. Stephens, animal husbandman of ARS and the Oklahoma Agricultural Experiment Station, and Oklahoma scientists L. S. Pope, L. M. Henderson, and D. O. Pinney.

The scientists intended originally that the maintenance-fed cows would be underfed. The animals each got about 1 pound of cottonseed meal daily from early November to mid-April each year, in addition to free-choice salt and bonemeal. The overfed cows got 2.5 pounds of cottonseed meal and 3 pounds of oats daily, plus the salt and bonemeal.

Despite the difference in feeding levels, however, the maintenance-fed cows weighed only about 50 pounds less than the overfed ones at maturity. The researchers say cows on the low feeding level were active grazers, while the others waited for feed.

About 50 percent more of the overfed animals were removed from the herd for failure to calve than those on restricted rations. And disease losses of overfed cows were twice as great.

The maintenance-fed group weaned lighter calves (an average of 479 pounds, compared to 483 pounds), but they lost fewer calves each spring between birth to weaning (3.9 percent vs. 8.6 percent).

Previous studies have demonstrated that when cows don't get enough feed to satisfy their nutrient requirements, their fertility decreases fast (see AGR. RES., Dec. 1961, p. 7).

The researchers say the low level of winter feeding, satisfactory in this study, may not be sufficient in other areas. The cows in both groups always had adequate grazing; each had about 10 acres of excellent native forage.☆

AGRISEARCH NOTES

Foam spray method dries milk

A new milk-drying process developed by ARS offers considerable savings in the manufacture of nonfat milk powder. It spray-dries highly concentrated milk foamed by the injection of compressed air or nitrogen.

The process was worked out by R. W. Bell, dairy manufacturing technologist, F. P. Hanrahan, engineer, and B. H. Webb, chemist. ARS Dairy Products Laboratory, Washington, D.C.

The USDA foam-spray method of drying is used with an improved evaporator developed by industry.

Three important reasons are cited by the researchers for the economy of the new process. First, more water is removed at less cost from the milk in the vacuum evaporator. Second, because there is less water to be removed in the drier, the rate of powder production is increased about 25 percent. Third, the so-called instantizing step (a procedure facilitating instant dispersion of milk powder in water) required in conventional spray drying is eliminated.

The foam-spray method dries liquids of higher solids content than conventional spray-drying methods.

Survey of honey is published

The effect of changes in farming practices on types of U.S. honey is reported in a new USDA publication, "Composition of American Honeys." It is the first analytical survey of American honeys in 50 years.

The 124-page book, based on ARS studies of the 1956 and 1957 crops, reflects advanced laboratory procedures for evaluating honey.

It shows the precise composition of 504 samples of honey and honeydew (secretion of certain insects that feed on plants) originating in 47 States and representing 83 single floral types, 93 blends of known compositions, and 4 honeydew types.

The publication, Technical Bulletin No. 1216, by Jonathan W. White, Jr., Mary L. Riethof, Mary H. Subers, and Irene Kushnir, is available from the Superintendent of Documents, Government Printing Office, Washington, D.C. for 40 cents a copy.

Stored moisture sets corn yield

Corn yields are directly related to the amount of stored moisture at planting time in western Minnesota and the eastern Dakotas, a 5-year USDA study shows.

Corn requires more moisture than normal rainfall provides during the growing season in that area.

From observations at 48 locations by ARS and the Minnesota and South Dakota Agricultural Experiment Stations, scientists conclude that farmers in the area can help insure a crop by adopting soil management practices that increase soil moisture before planting time. These practices might include overwinter mulches, contour plowing, and soil preparation.

The researchers found that corn yields were most dependent upon stored moisture at planting time in years when July rainfall was below the 75-year average. Corn plants have their greatest need for moisture in July, when growth is rapid.

The studies also showed that the fine-textured soils of the northwestern Corn Belt generally do not contain as much moisture at corn-planting time as they are capable of holding.

Sugarcane is mass inoculated

A high-pressure spray method of inoculating sugarcane seedlings with mosaic virus—developed in ARS—has proved the most effective yet devised and is widely used here and abroad. Breeders in Louisiana, Mississippi, Georgia, Florida, and Hawaii now use it exclusively.

Artificial inoculation is the first screening step in breeding sugarcane varieties resistant to mosaic. Breeders discard all inoculated plants that show disease symptoms. Scientists frequently need seven or eight years to evaluate and select usable commercial varieties from the remaining healthy seedlings.

Spray inoculation replaces laborious hand rubbing of each seedling, besides giving higher infection rates. The technique greatly reduces the

labor required in inoculating a million sugarcane seedlings annually in the U.S.

Mosaic, which has caused enormous economic losses, is one of the first major sugarcane diseases to be brought under satisfactory temporary control through development of resistant or tolerant varieties. Such varieties eventually lose their productive ability, however. And new strains of the insect-transmitted mosaic virus continue to appear. Therefore, breeders must continually develop new resistant varieties.

Two years ago, at the U.S. Sugar Crops Field Station at Meridian, Miss., plant pathologist J. L. Dean developed a method of spraying seed-

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lings with an atomizer containing inoculum and fine sand. Recent studies indicate that infection can be obtained by spray pressure alone and that the sand may be eliminated.

Test is found for citrus hardiness

It may soon be possible for plant breeders to determine the cold hardiness of citrus breeding material without growing plants in the field or exposing them to winter weather.

In studies at Weslaco, Tex., ARS scientists, cooperating with the Texas Agricultural Experiment Station, have found a new way to screen citrus seedlings for cold hardiness.

The key to the new screening method is a correlation between cold hardiness and the night temperature required to induce dormancy. Varieties that went into dormancy in response to relatively high night temperatures were more cold-hardy than

varieties that did not go into dormancy until night temperatures became relatively low.

In the dormancy tests, ARS plant physiologist R. H. Young and chemist A. Peynado exposed seedlings of 7 citrus species to night temperatures gradually reduced from 60° to 48° F. After this 38-week preconditioning period in a growth chamber, the plants were moved to a dark chamber where they were exposed to a low temperature (21° F.) for 4 hours. After 2 weeks in a greenhouse, the seedlings were examined for freeze injury.

Trifoliate oranges were the most cold-hardy, followed by citrumelos, mandarins, citranges, grapefruit, limes, and lemons. The scientists found that winter hardiness of seedlings, as determined in the indoor tests, was similar to known cold hardiness of mature trees under actual field conditions. Further tests will be conducted to confirm the findings.

New hog cholera shipping rules

New interstate shipping rules for swine—to help prevent spread of hog cholera—have been adopted by USDA in support of the cooperative State-Federal eradication campaign.

Here is a rundown on the new regulations, which take effect this month. The rules prohibit—

- Interstate shipment of infected and exposed hogs.
- Interstate shipment of hogs fed raw garbage.
- Interstate shipment, after January 1, 1963, of virulent virus, and of feeder pigs and breeding stock treated with this virus.

No restriction is imposed on healthy hogs shipped interstate for slaughter.

Other provisions set forth requirements for interstate shipment of feeder pigs and breeding swine. In general, these animals must be officially vaccinated and accompanied by a health certificate. The specific requirements depend on origin and the destination of shipment.

State and Federal veterinary officials can furnish complete details.

Insect records are microfilmed

From petty thievery to grand larceny, damage insects do around the world is recorded at Washington, D.C., in the Nation's—probably the world's—largest store of such data.

It includes valuable information on distribution, food sources, biology, and general history of the pests, going back to the middle 1700's.

To reduce filing space, the 500,000-odd notes on approximately 42,000 species of insects of economic importance are now being placed on microfilm and microtape.

These ARS records supplement those kept in the National Insect Collection at the Smithsonian Institution in Washington (AGR. RES., May 1962). Information is available to the public on request. ARS regulatory workers and State and local agencies use this information in keeping unwanted insects out of the U.S. and preventing spread of those already here. Other users are public health workers, veterinarians, students, scientific writers, and entomologists the world over.

The information is compiled primarily as a working tool for the Cooperative Economic Insect Report, a compilation of insect occurrence issued each week by ARS.

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